

Written Reply

The PCT written opinion dated 17 October 2003 has pointed out that claims 1 and 6 will not be the subject of the international preliminary examination. In the international search report dated 13 October 2003, it has been reported that claims 1 and 6 include a parameter "the endothermic amount of said paraffin wax of said microcrystalline wax obtained by differential scanning calorimetry up to 45°C is not more than 1.0 J/g.", which leads to a lack of clarity, and hence the search has not been performed completely. Further, it has also been pointed out that claims 2, 4 and 5, which are dependent on claim 1 reciting the definition of the endothermic amount, will not be the subject of the international preliminary examination either.

(1) As to claims 1 and 6

In claims 1 and 6, the temperature range for obtaining the endothermic amount has been amended to 20 to 45°C so that the scope of the present invention is clarified. This amendment is based on the technique for obtaining the endothermic amount mentioned in Examples (on page 11, lines 3-6 of the description), as well as the obtained endothermic amount shown in Table 1.

Please find attached Japanese Laid-Open Patent Publication No. 2001-312093 and English abstract thereof, which is a prior art document including a definition by the endothermic amount obtained by differential scanning calorimetry. Claim 1 of the publication includes the limitation that "(the developer shows) not more than 25 J/g endothermic energy at not higher than 100°C measured by differential scanning calorimetric". That is, in the same manner as the present invention, it has been conventional to recite the endothermic amount obtained by the differential scanning calorimetry as a parameter. Therefore, it is possible to compare the parameter of the present invention with what is set out in the prior art.

From the above reasons, present independent claims 1 to 6 are clear and searchable, and will be the subject of the international preliminary examination.

(2) As to claims 2, 4 and 5

As described in the above, claim 1 will be the subject of the international preliminary examination. Therefore, claims 2, 4 and 5 dependent on claim 1 should also be the subject of the international preliminary examination.

In the field of manganese dry battery, no prior art was found in which a wax used for a positive electrode

current collector is defined by the endothermic amount.

Attachments:

Japanese Laid-Open Patent Publication No. 2001-312093 and
an English abstract thereof

features thereof, from the following detailed description taken in conjunction with the drawings.

Brief Description of drawings

Figure 1 is a front view showing a manganese dry battery in accordance with the present invention with a part cross section thereof.

Best Mode for Carrying out the Invention

The positive electrode current collector for a manganese dry battery of the present invention comprises a carbon rod and either one of a paraffin wax containing hydrocarbon whose molecular weight is 300 to 500 and a microcrystalline wax containing hydrocarbon whose molecular weight is 500 to 800, which is impregnated into the carbon rod, is characterized in that the endothermic amount of the paraffin wax or the microcrystalline wax obtained by differential scanning calorimetry at 20 to 45°C is not more than 1.0 J/g.

The greatest feature of the present invention is to use specific waxes to be impregnated into the carbon rod as described above, in order to maintain the sealing performance of an obtained battery even if a low-density carbon rod is employed.

It is necessary that the wax to be used in the present invention has an the endothermic amount, which is

a larger amount of paraffin with which to be impregnated because a low-density carbon rod is highly porous. This increases the amount of paraffin wax to elute during the storage at 45°C, thereby inducing the sealing agent to melt, with the problem of sealing failure.

Therefore, it is an object of the present invention to provide a positive electrode current collector for a manganese dry battery which is freed from the above-mentioned problem and is capable of keeping the sealing performance of the battery in a good condition during high-temperature storage even with a low-density carbon rod.

Disclosure of Invention

The positive electrode current collector for a manganese dry battery of the present invention comprises a carbon rod, and either one of a paraffin wax containing hydrocarbon whose molecular weight is 300 to 500 and a microcrystalline wax containing hydrocarbon whose molecular weight is 500 to 800, which is impregnated into the carbon rod, is characterized in that the endothermic amount of the paraffin wax or the microcrystalline wax, which is obtained by differential scanning calorimetry at 20 to 45°C, is not more than 1.0 J/g.

It is preferable that the positive electrode current collector for a manganese dry battery satisfies the relational expression: $90 < Y + 50.5X < 100$ wherein X is the

CLAIMS

1. (Amended) A positive electrode current collector for a manganese dry battery comprising: a carbon rod; and either one of a paraffin wax containing hydrocarbon whose molecular weight is 300 to 500 and a microcrystalline wax containing hydrocarbon whose molecular weight is 500 to 800, which is impregnated into said carbon rod,

characterized in that the endothermic amount of said paraffin wax or said microcrystalline wax obtained by differential scanning calorimetry at 20 to 45°C is not more than 1.0 J/g.

2. The positive electrode current collector for a manganese dry battery in accordance with Claim 1, characterized by satisfying the relational expression:

$$90 < Y + 50.5X < 100$$

wherein X is the density (g/cm³) of said carbon rod, and Y is the entire endothermic amount (J/g) of said positive electrode current collector obtained by differential scanning calorimetry at 20 to 100°C, and Y>0.

3. The positive electrode current collector for a manganese dry battery in accordance with Claim 1 or 2, wherein said carbon rod has a density of 1.55 to 1.75 g/cm³.

4. The positive electrode current collector for a manganese dry battery in accordance with Claim 1, wherein in the entire endothermic amount of said positive electrode

current collector obtained by differential scanning calorimetry at 20 to 100°C, the endothermic amount obtained by differential scanning calorimetry at 20 to 55°C is not more than 25%, and the endothermic amount obtained by differential scanning calorimetry at 20 to 60°C is more than 25% and not more than 40%.

5. The positive electrode current collector for a manganese dry battery in accordance with Claim 4, wherein in the entire endothermic amount of said positive electrode current collector obtained by differential scanning calorimetry at 20 to 100°C, the endothermic amount obtained by differential scanning calorimetry at 20 to 65°C is more than 40% and not more than 70%.

6. (Amended) A manganese dry battery comprising a positive electrode current collector: said positive current collector comprising a carbon rod and either one of a paraffin wax containing hydrocarbon whose molecular weight is 300 to 500 and a microcrystalline wax containing hydrocarbon whose molecular weight is 500 to 800, which is impregnated into said carbon rod,

characterized in that the endothermic amount of said paraffin wax or said microcrystalline wax obtained by differential scanning calorimetry at 20 to 45°C is not more than 1.0 J/g.